Improving Water Quality Through *Understanding* and *Action*

By Patrick E. Lindemann
Ingham County Drain Commissioner

Patrick E. Lindemann

Growing clamor for cleanup

- 1965: Federal government intervenes in serious Great Lakes pollution
- 1966: *Life* declares Lake Erie dead
- 1969: Cuyahoga River at Cleveland catches fire

Michigan responds again

- 1968: Voters approve $335 million clean water bond to upgrade sewage treatment
- 1970: Michigan enacts “truth-in-pollution” law; cities and industries report what they store and discharge into public waters
- 1970-72: Michigan Environmental Protection Act, Inland Lakes/Streams Act

More Michigan leadership

- 1972: Federal Clean Water Act sets goal of fishable, swimmable waters by 1985
- Concentrates on “end-of-pipe” controls
- 1977: Michigan cracks down on phosphorus pollution by limiting detergent phosphate content
- 1977: Michigan enacts wetlands protection

Red Cedar River 1966
Picture taken from Farm Lane Bridge
on MSU Campus

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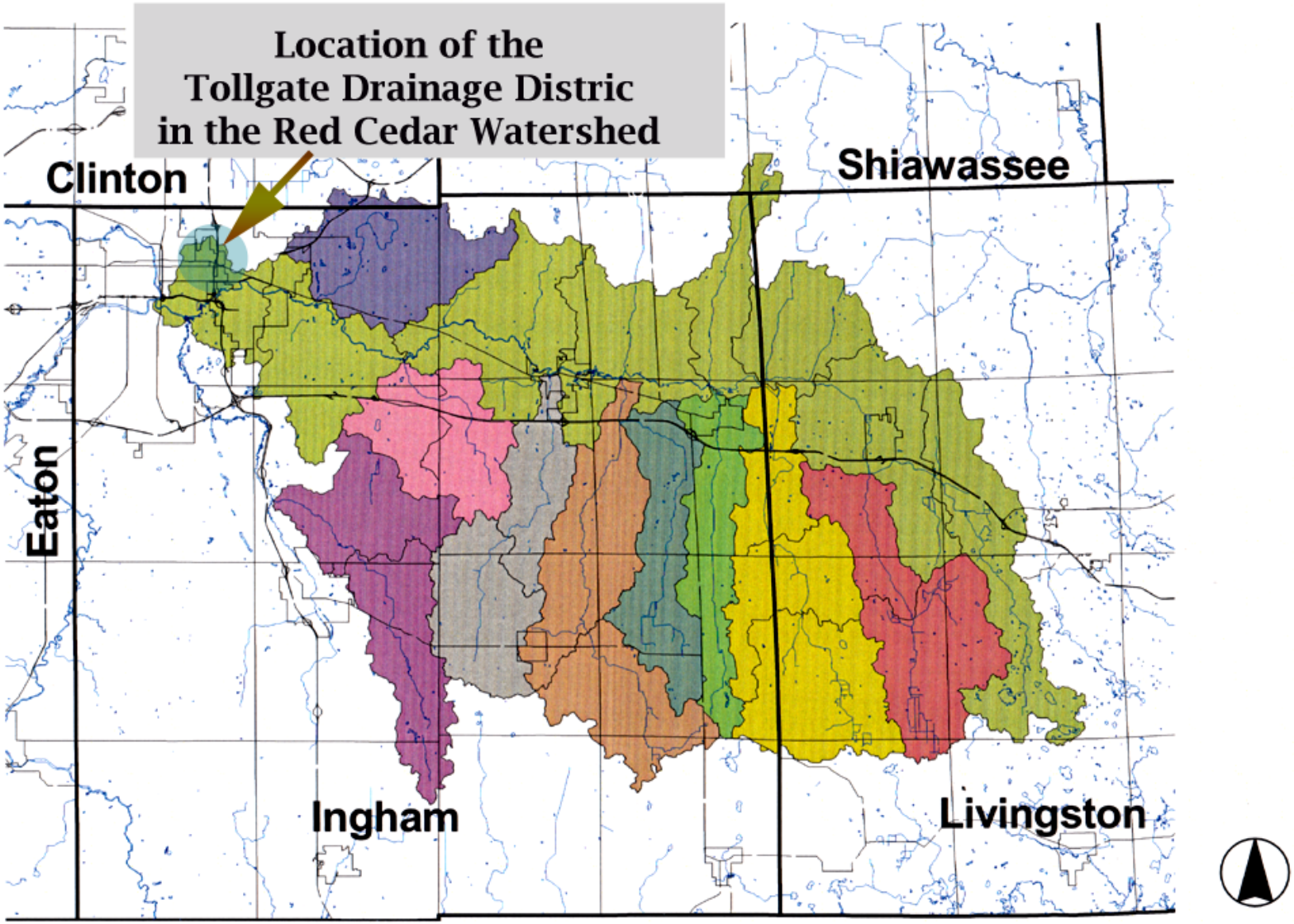
We have come far
But we have a long way to go

Red Cedar River 2001
Picture taken from Farm Lane Bridge
on MSU Campus



TETRA TECH MPS

DESIGNED: JEH DATE: 7-9-01

Deer Creek
Dietz Creek
Doan Creek
Kalamink Creek
M Br Red Cedar River
Mud Creek
Mud creek
Pine Lake Outlet
Red Cedar River
Sloan Creek
W Br Red Cedar River
Hydrology
County Boundaries
Municipal Boundaries

Red Cedar Watershed 319 Grant Application

Red Cedar Watershed

FIGURE 1

Removal of Nonpoint Source Pollutants by an Urban Stormwater Wetlands System in Lansing Township, Michigan

Patrick E. Lindemann
Ingham County Drain Commissioner

Karen G. Wayland, Tetra Tech MPS
Erich P. Ditschmann, Tetra Tech MPS

June, 2001

Section 319 Grant Goals and Objectives

- Determine Quality and Quantity of Stormwater from the Drainage District
- Determine Treatment Efficiency of the Wetland
- Increase Public Participation and Education
- Document Wetland Operation, Maintenance Requirements and Associated Costs

THE PROJECT TEAM

Ingham County Drain

Commissioner

Patrick E. Lindemann

Prime Consultant

Fishbeck, Thompson, Carr & Huber Inc.

7402 Westshire Suite 110

Lansing, MI 48917

Design Consultant

Midwest Environmental Consultants, Inc.

6075 Jackson Road

Ann Arbor, MI 48103

What Is A Watershed?

A watershed is a geographical area through which water seeks a common outlet.

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What Is A Watershed?

A watershed is a geographical area which holds a system of many complex and interrelated sets of an ecosystem (layers) that are interdependent on a common flow of energy, material transport (waste removal), and nutrient input and output as a result of water collection, storage and movement.

Patrick E. Lindemann (1996)

Thinking from a watershed perspective, means thinking "systemically" or "systems thinking."

Stake Holders

- Michigan Department Environmental Quality (DEQ)
- Ingham County Drain Commissioner
- Ingham County Road Commission
- City of Lansing
- Lansing Township
- District Residents and Property Owners

Typical Property Owner

(Based on Baseline Survey Distribution Mean)

- **Lived in district 20 to 30 years**
- **Lives on fixed income**
- **Does not like change**
- **Does not trust public officials**
- **Does not consider self an environmentalist**

Point Source Pollution
And
Non-point Source Pollution

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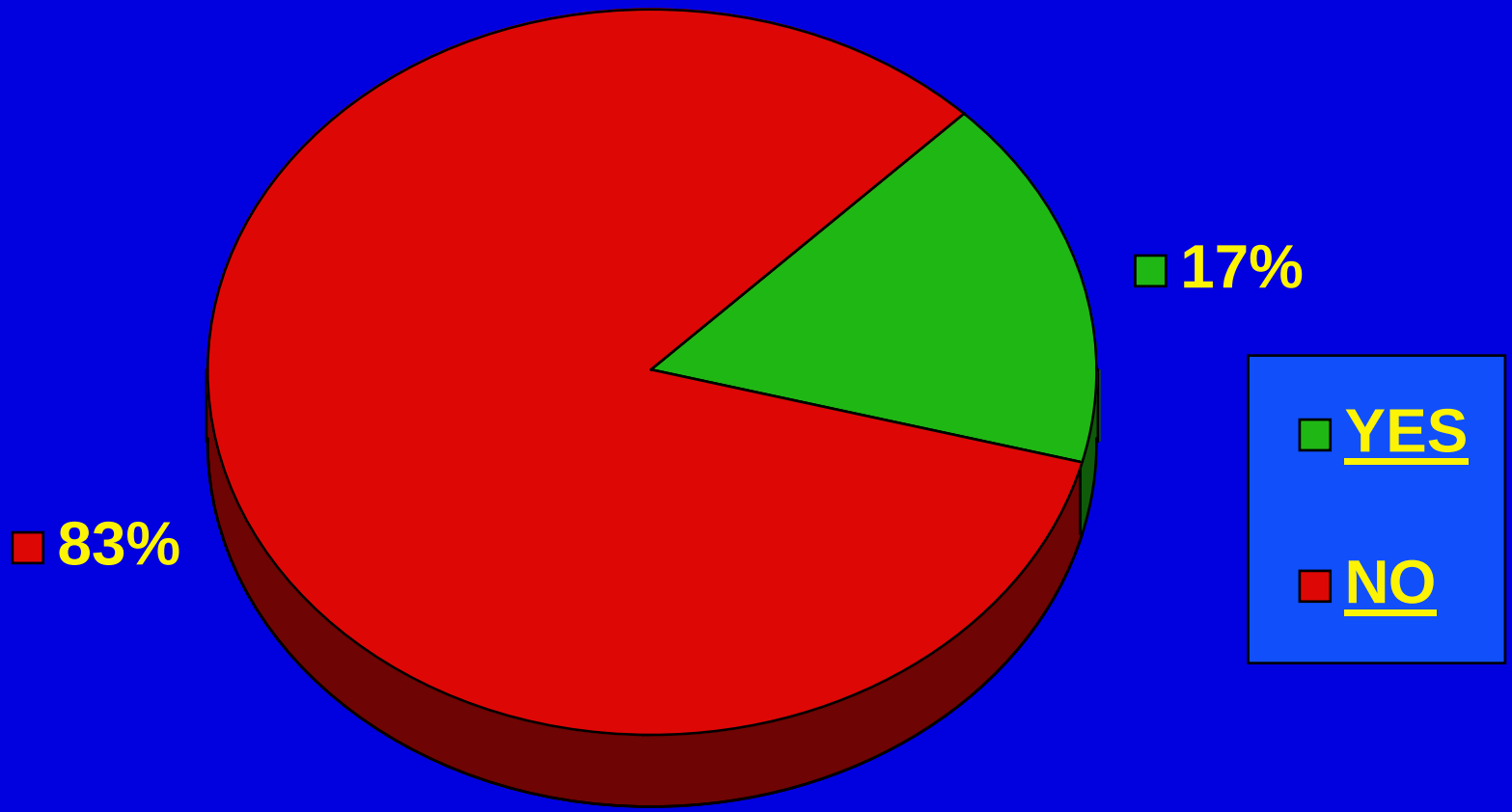
Tollgate Survey

Do you know what nonpoint source pollution is?



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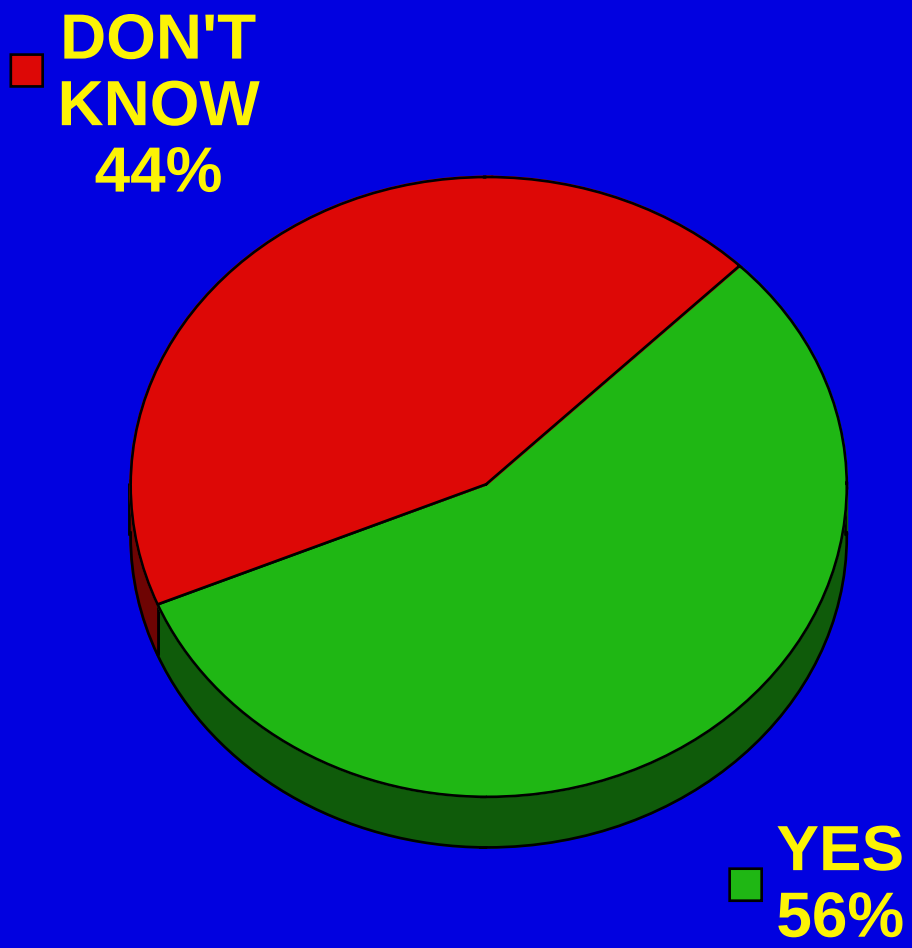
Willow Creek Riparian Survey

Do you know what a watershed is?



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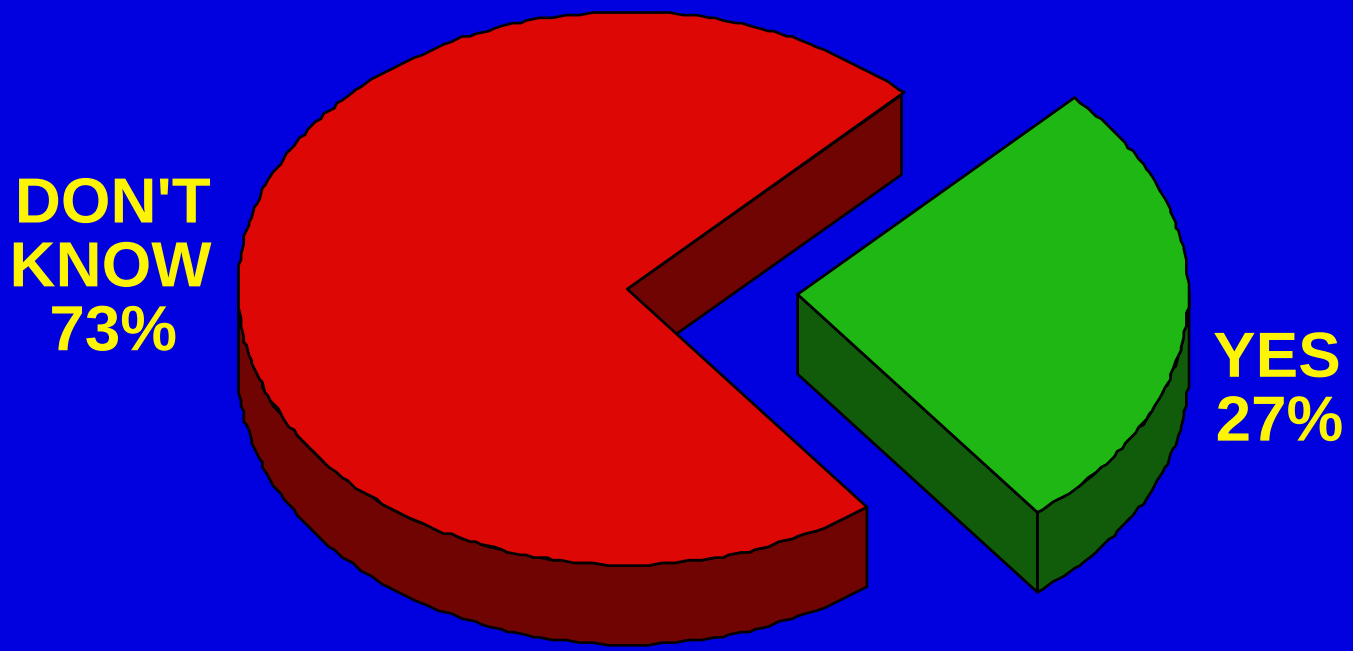
Willow Creek Riparian Survey

Do you know what nonpoint source pollution is?



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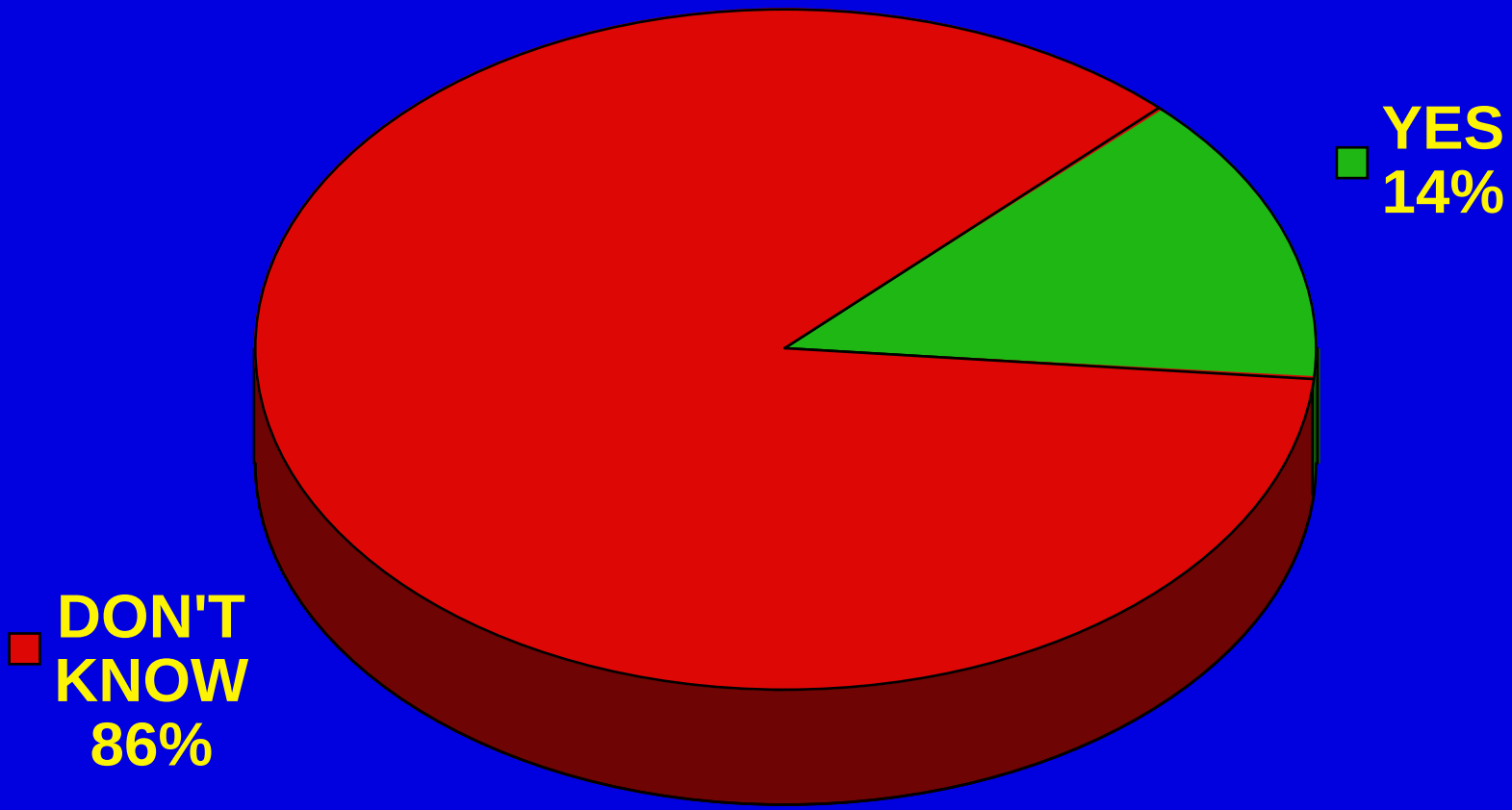
Willow Creek Riparian Survey

Do you know what the relationship between nonpoint source pollution and the watershed is?



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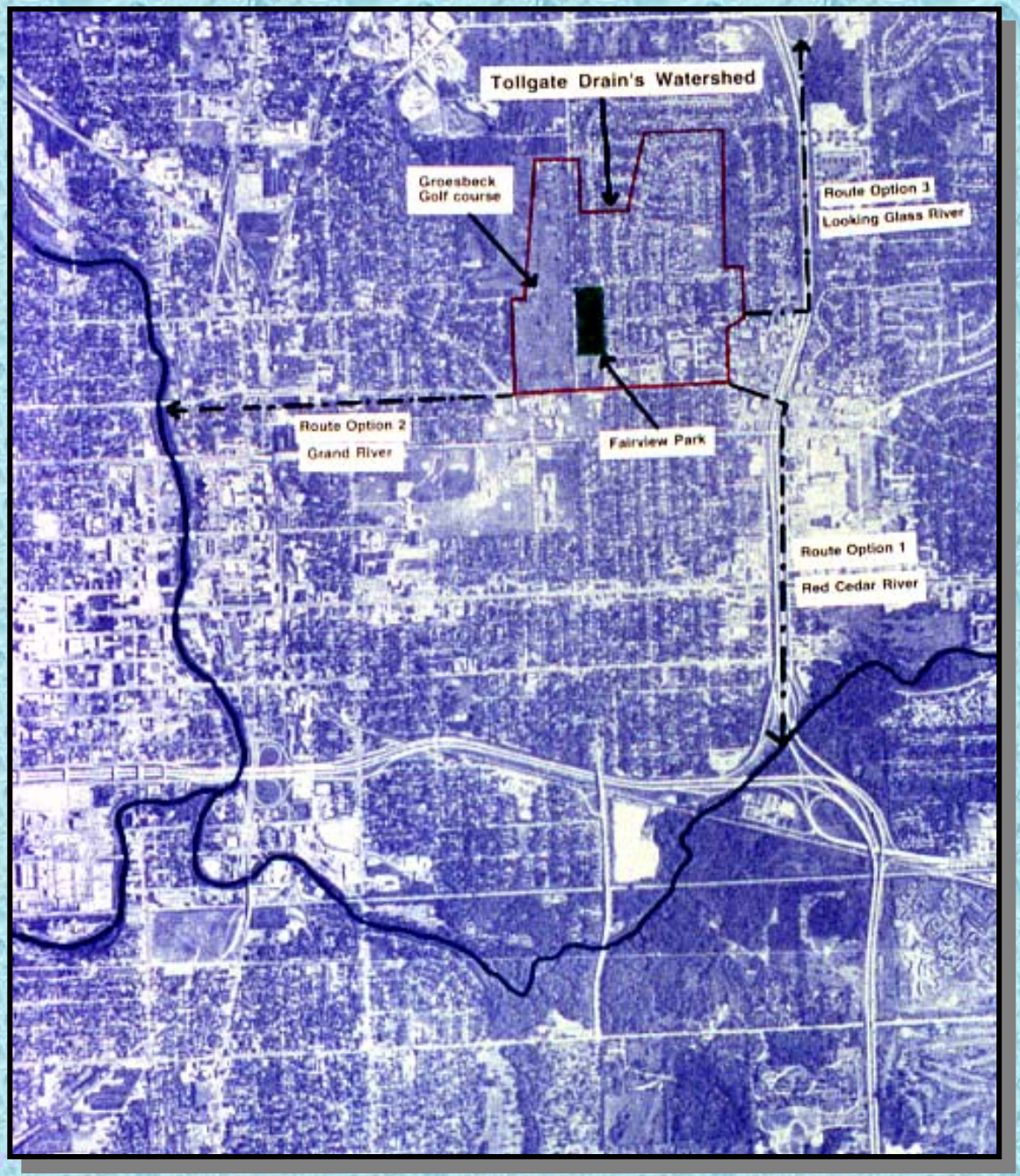
The Problem

- Intergovernmental Storm Water Challenges
  - Combined Sewer Overflows (Lansing)
  - No Outlet for Storm Water (Lansing Township)
  - Intergovernmental Agreement for Sanitary Sewer
- Inadequate Drainage System (Basements and Roads Flooded)
- Stakeholder Conflicts
- Stakeholders Trapped in Traditional Thinking

Traditional Thinking

- **Hard vs. Soft Engineering**
  - Hard
    - Piping water to nearest river or stream
    - Unacceptable amount for Township: $20,000,000 to $30,000,000
  - Soft
    - Retain water on site and better use natural processes
    - Affordable to Stakeholders: $6,200,000
- **Annexation vs. Cooperation**
- **Status Quo vs. Change**



Traditional Options

Option 1

Take storm water to the south and outlet to the Red Cedar River. Cost about 23 million dollars.

Option 2

Take storm water to the west and outlet to the Grand River. Cost about 26 million dollars.

Option 3

Take storm water to the north and outlet to the Looking Glass River. Cost about 29 million dollars or more.

DENNIS THE MENACE

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THE TOLLGATE DRAIN'S WATERSHED

- 234 acre watershed
- 554 residential properties
- 20+ commercial properties
- 1000+ apartment units

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The Solution

- **Develop Multi-objective Project Concept to address Problems**
- **Build Consensus and Stakeholder Buy In**
- **Intergovernmental Agreements**
  - Permits
  - Easement
  - Cost Sharing
- **Ongoing Public Outreach**

Create Wetland/Upland Retention and Water Treatment System

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The Tollgate Watershed is a densely developed neighborhood.

The Multi-objective Project

- Separating Sanitary and Storm Sewers
- Create Wetland/ Upland Retention and Water Treatment System
- Improve Golf Course
- Create Aesthetic, Environmental, and Recreational Neighborhood Amenity
- Education and Public Outreach

Criteria for Plant Selection

- Native to area
- Foraging and/or habitat functions
- Water quality and/or quantity effects

The Tollgate Drain Project And Its Watershed

Photo taken right after construction was finished

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Separating Sanitary and Storm Sewers

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The Beginning of Construction

One of 3 Main Stormwater Leads Draining to the Wetlands

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The Sanitary Sewers in the Neighborhood Were Rebuilt and New Hook-ups to the Houses Were Provided

The neighborhood streets under construction for over a year

Create Aesthetic, Environmental, and Recreational Neighborhood Amenities

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Before construction, looking north on Fairview Street.

Looking north after construction on Fairview Street.

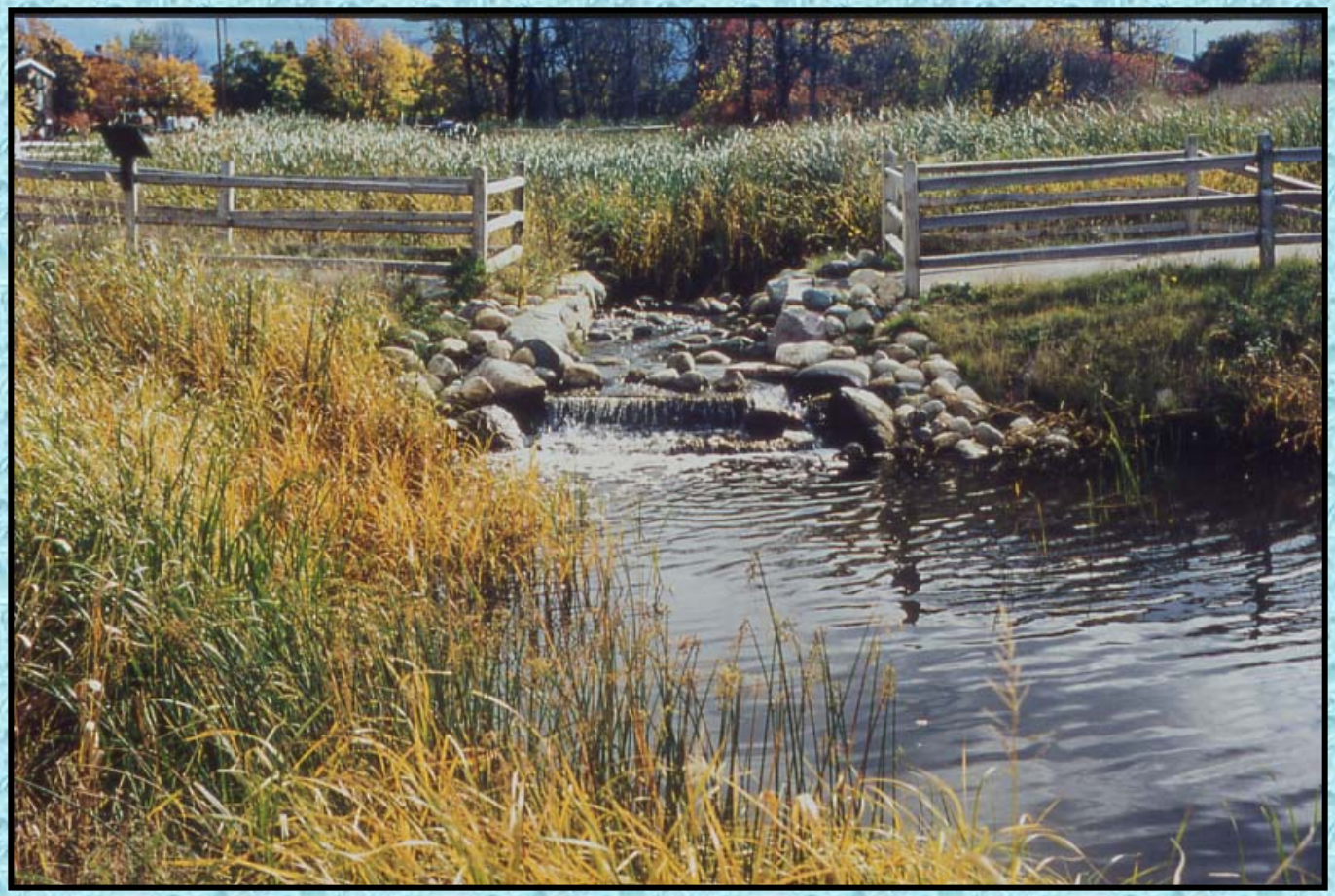
Before construction, looking south from Hopkins Street. This seven-acre site, located in Lansing Township, owned by the State of Michigan, and maintained as a park by the City of Lansing, is the site of the first set of project ponds.

Before construction.

Before construction, the seven acres were primarily a monoculture of reed canary grass.

The lower pounds weeks after construction

After 6 months the transition is clear



Second waterfall draining into the peat filter.

Second waterfall draining into the peat filter.

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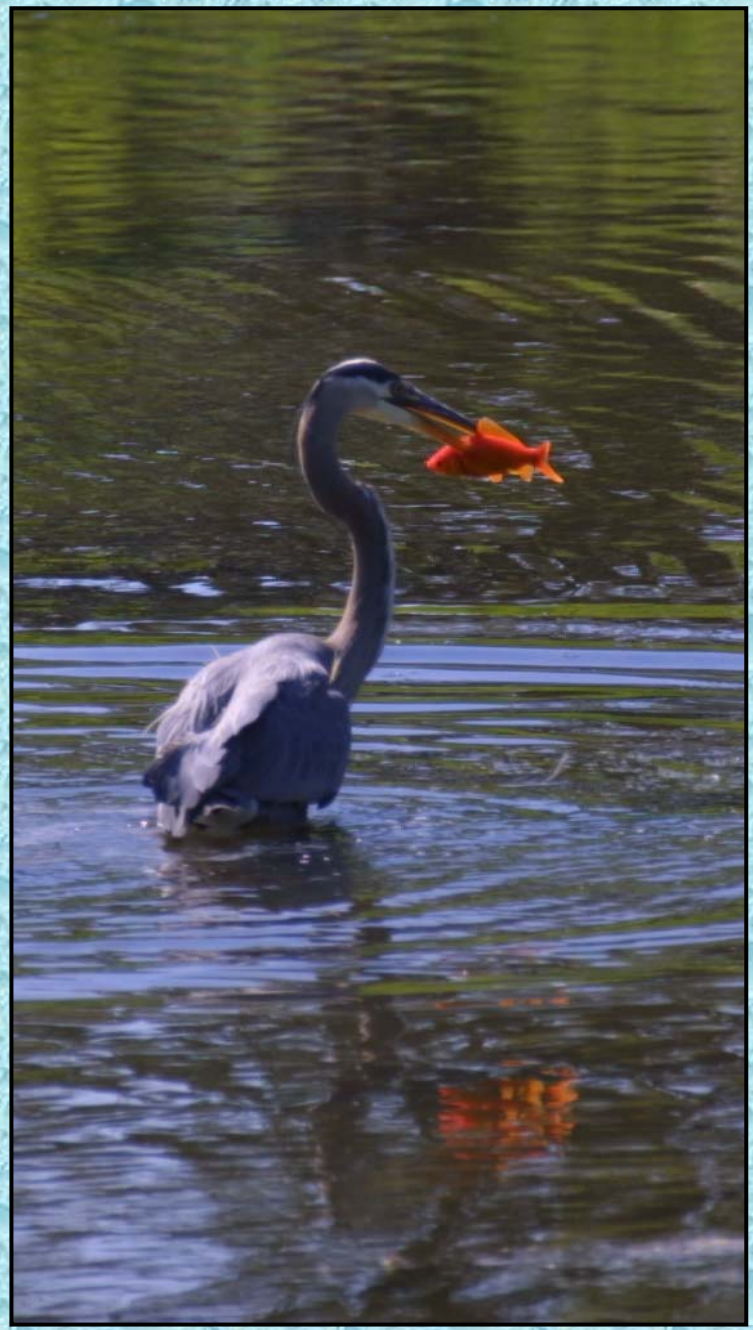

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The wetlands first family out for a walk taking in the beauty of the pounds

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Pearl crescent moth, found near ponds.

Pond lilies help to evaporate water by transovaporation and evaporation. They also take up nutrients from the water while providing an attractive addition to the wetlands.

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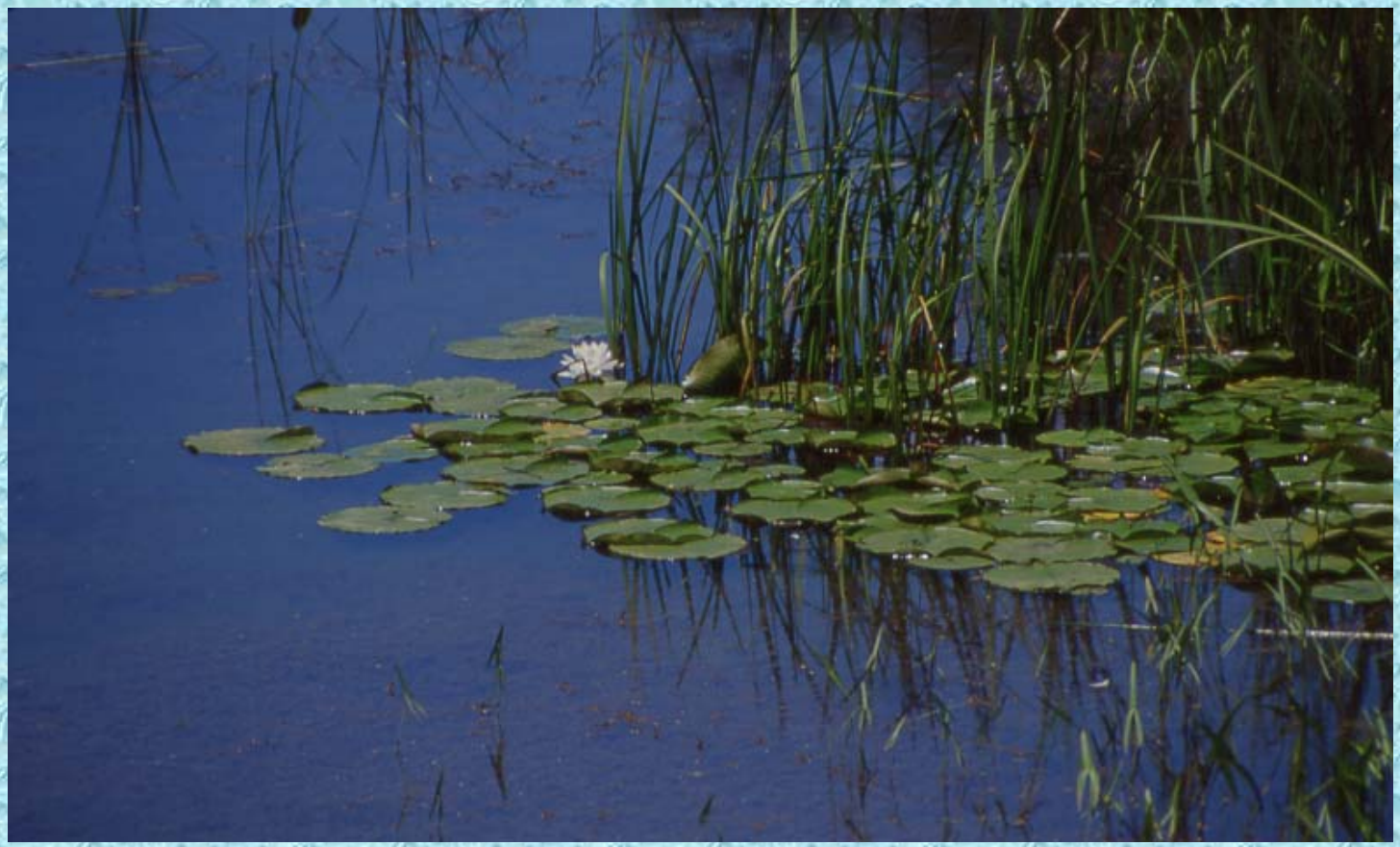

Water lilies and Broadleaf Arrow Head with Narrow Leaf Cattails form a scenic vista at the wetlands. It is not uncommon to find many people of all ages with easels set up around the ponds, painting pictures of the wetlands. I call this picture the "Tollgate Wetland's Monet."

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Improve Golf Course

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The Tollgate Watersheds drain to the City of Lansing's Groesbeck Golf Course

Groesbeck Golf Course, a municipal golf course, had no water features prior to the construction of this project. This picture shows the golf course prior to construction.

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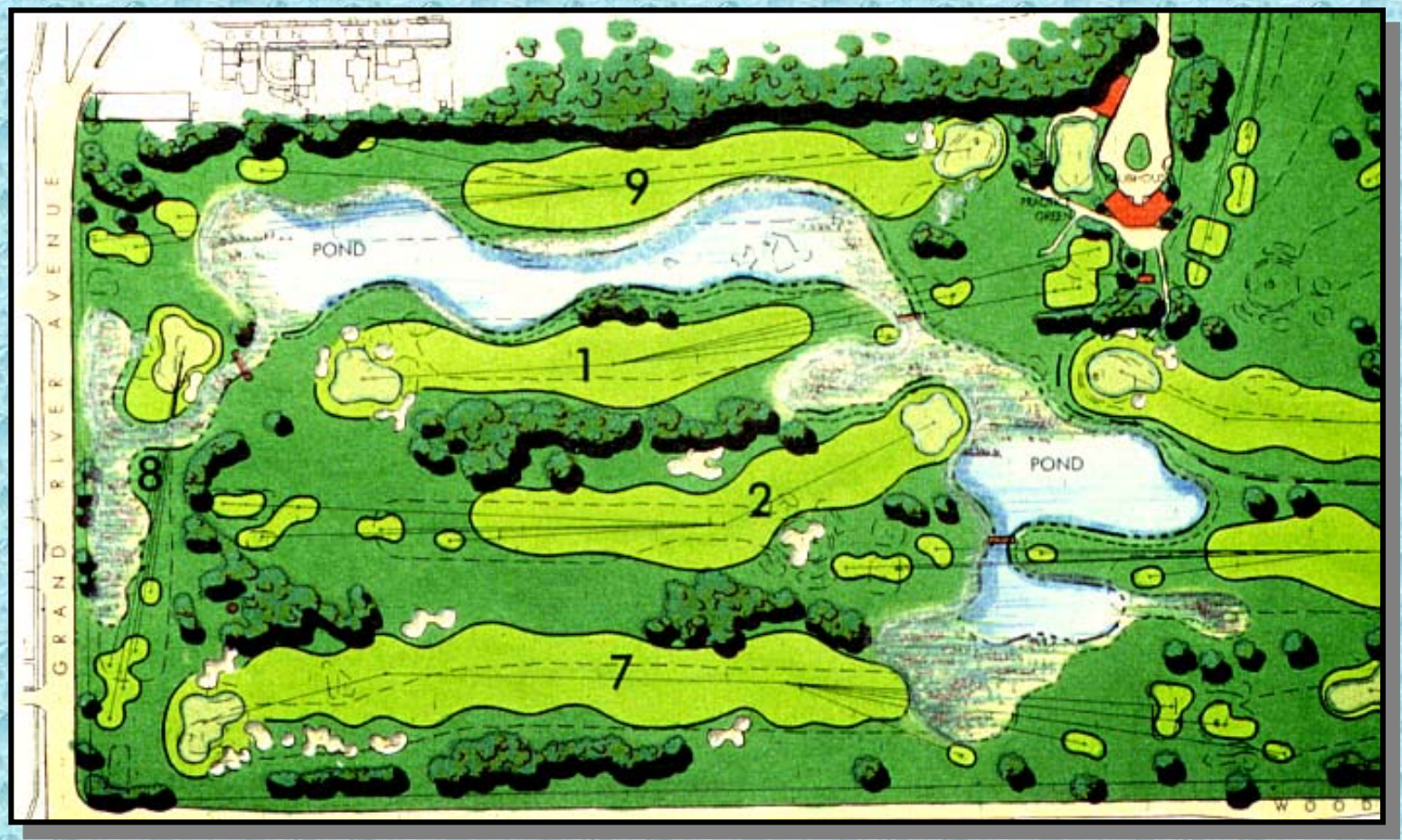

Looking east over golf course wetlands.

Opening day started off a new era at this municipal course.

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Looking east over the golf course just after opening the course to the public. The storm water ponds meander through the course.

Looking south at the largest pond in the system: This pond is the irrigation reserve for the golf course. It lowers the cost of operation for the golf course and helps recycle the pollution from the water that the golf course puts into the system.

Looking east across the golf course

Wildflower and native vegetation buffer strip around the storm water ponds

Wetland flower buffers around the ponds

The wildflower buffers around the ponds on the golf course take up some of the nutrients loading from the fairways.

Wildflower Pond Buffers

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Education and Public Outreach

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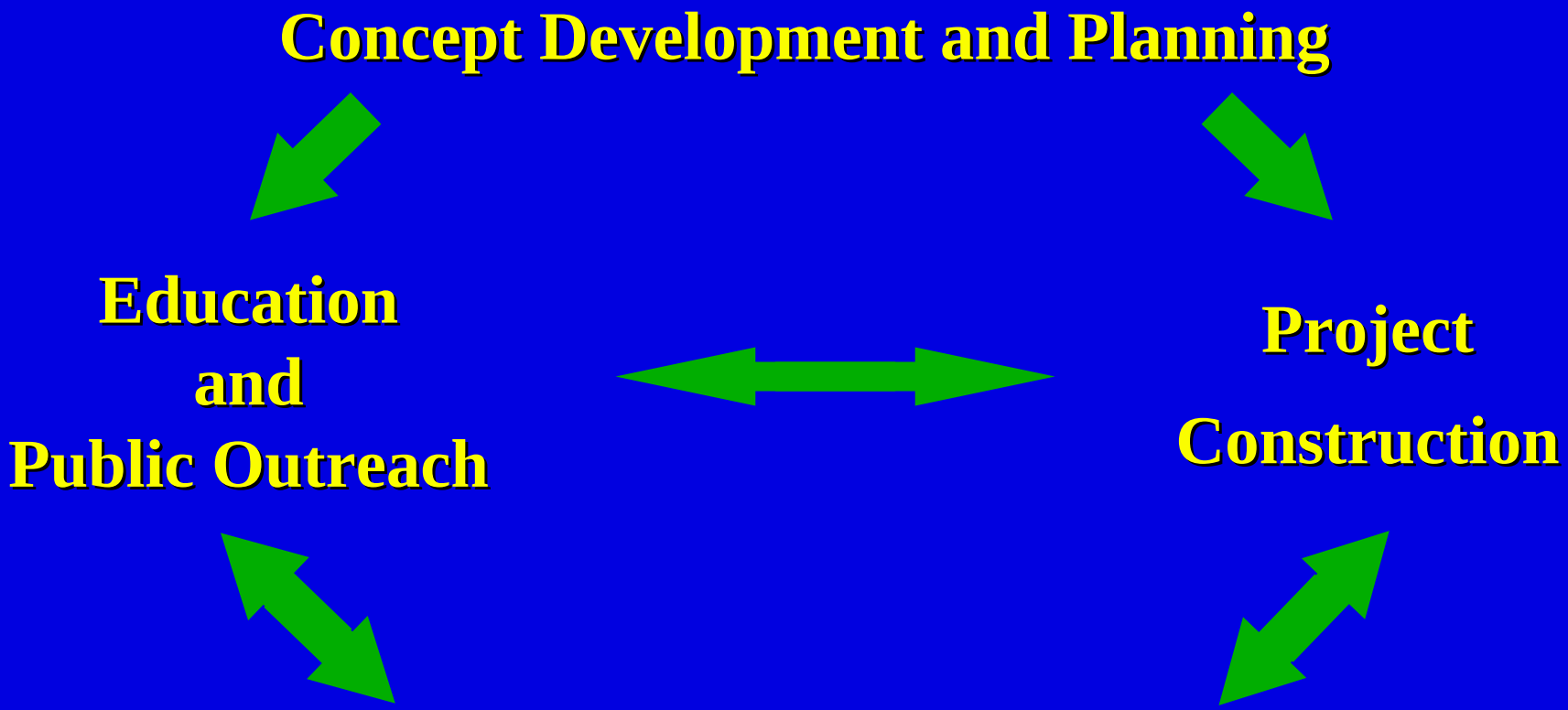
Long Term Assessment and Maintenance

- Assessment
  - Water Quality Monitoring
  - Education and Outreach Efficacy
- Maintenance
  - Water Treatment System
  - Catch Basins
  - Education and Outreach

Tollgate Drain Project



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Education and Public Outreach

During the Construction Phase

- Held Public Meetings
- Conducted Surveys
- Developed Neighborhood Network
- Created On-site Office for Project and Made Project Representatives Available
- Distributed Project Updates and Educational Materials to Neighborhood
- Gave Tours of Project to a Variety of Stakeholders

Lectures and tours are given regularly to classes of all sizes.

School children from nearby school have built class activities around the wetlands.

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Goals of Education and Public Outreach-

During the Construction Phase

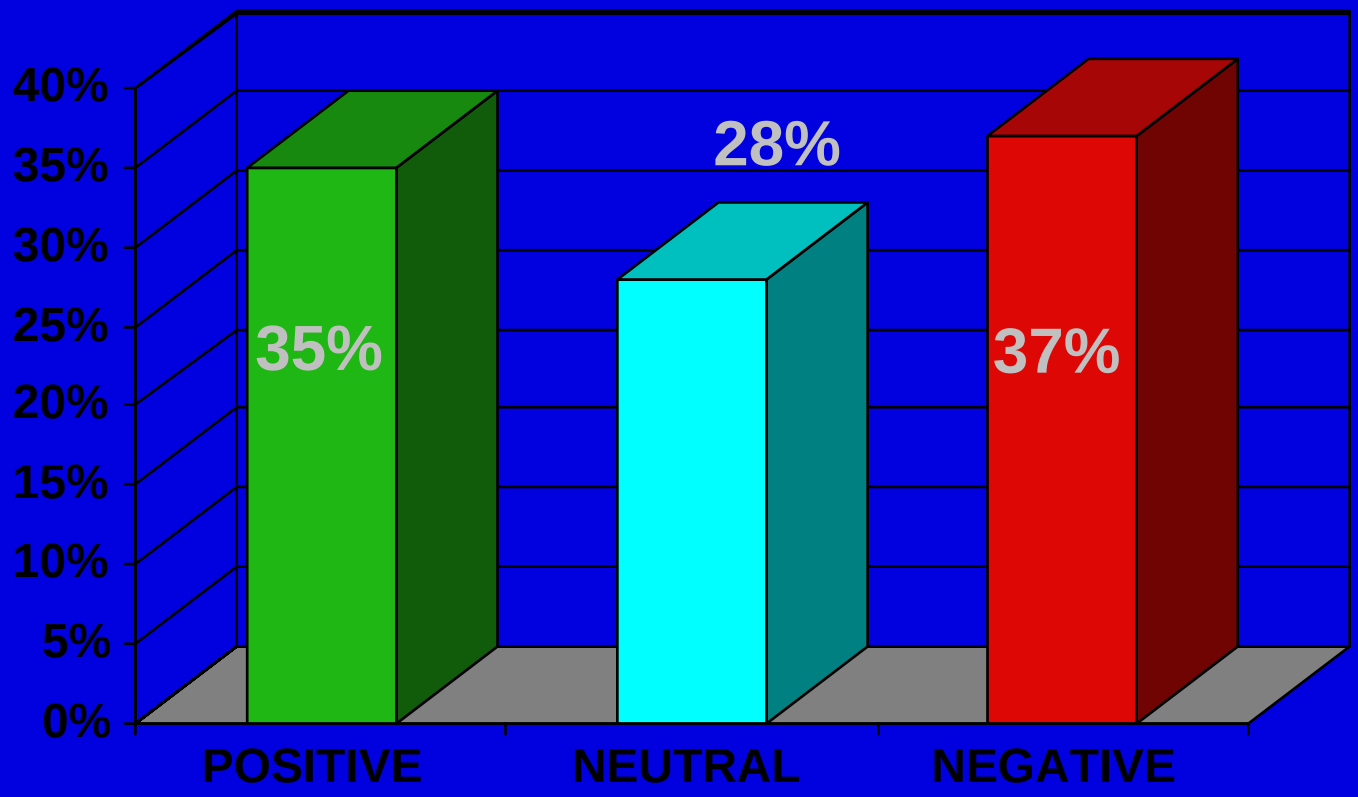
- Facilitate Community Participation and Ownership of Multi-objective Project
- Change Attitudes about Multi-objective Project

Measuring Education and Public Outreach Success

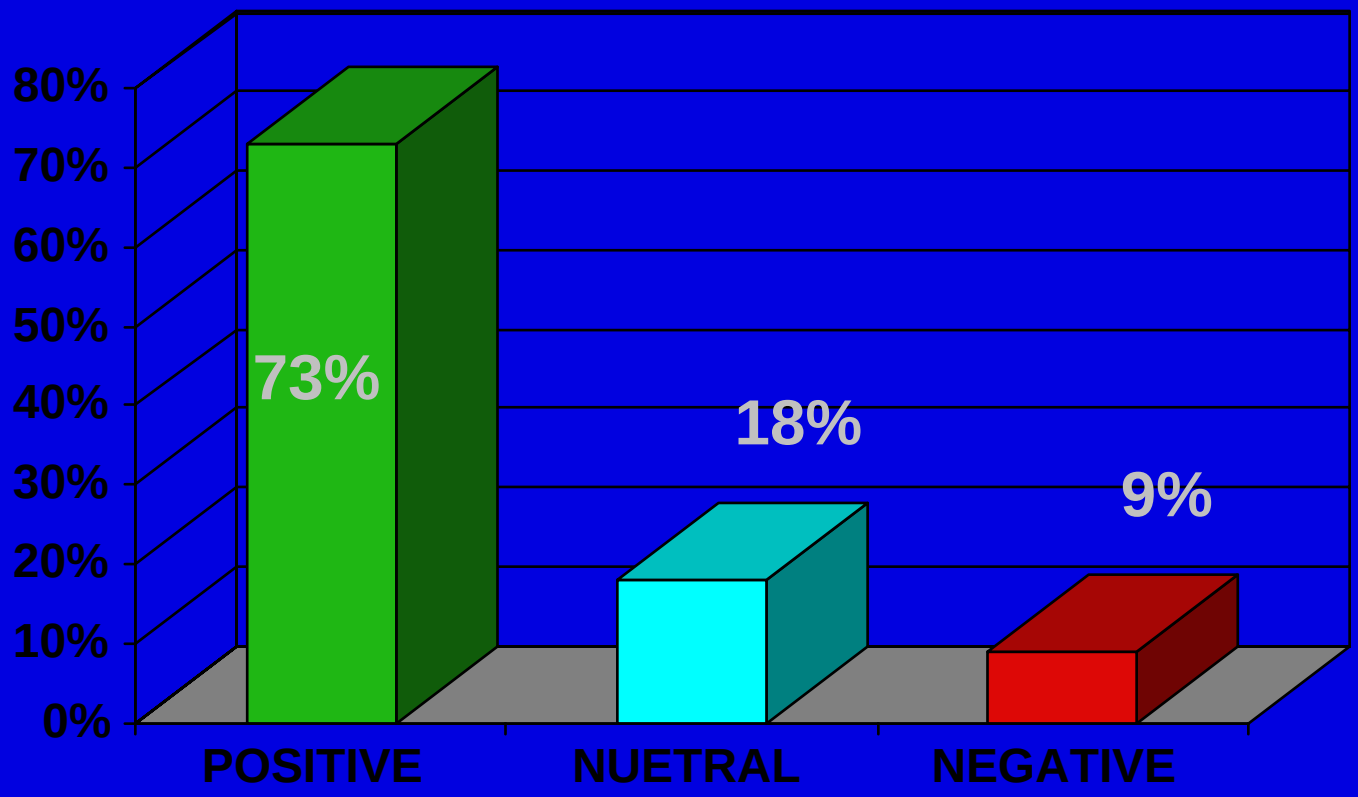
During the Construction Phase

- Community Participation and Ownership of Project was Achieved
- Attitudes about Multi-objective Project were Changed

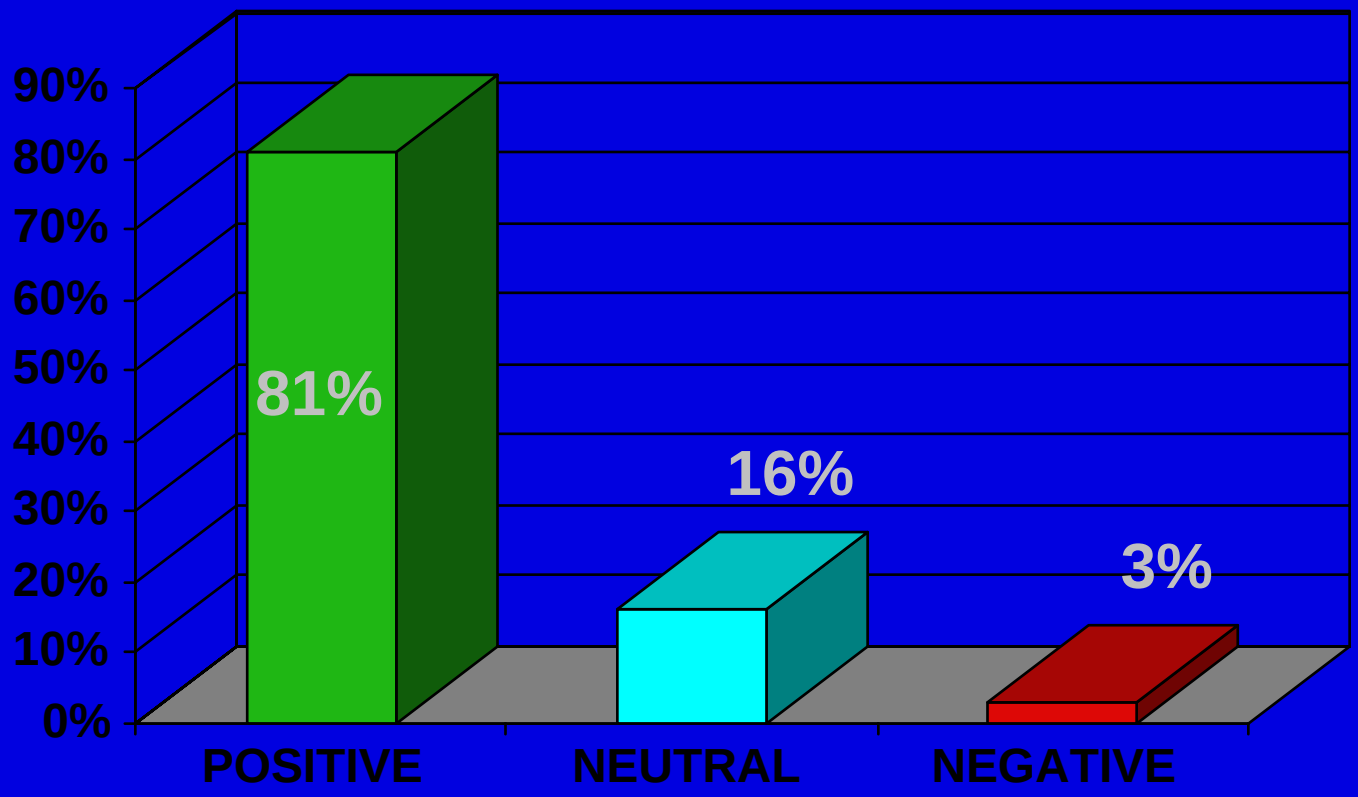
Attitude Toward The Tollgate Project Before Construction



Attitude Toward The Tollgate Project During Construction



Attitude Toward The Tollgate Project After Construction



Education and Public Outreach:
Long Term Assessment and Maintenance

- Further Surveying and Water Quality Monitoring
- Monitoring Data and Feedback Loop
- Maintain Neighborhood Presence
- Ongoing Education: Neighborhood, Educational Institutions, Environmental Groups, and Service Clubs

The cattails are harvested each fall to take away the nutrients they have taken up through the year. These young men are doing community service work by court order.

Test Results
Year 2000

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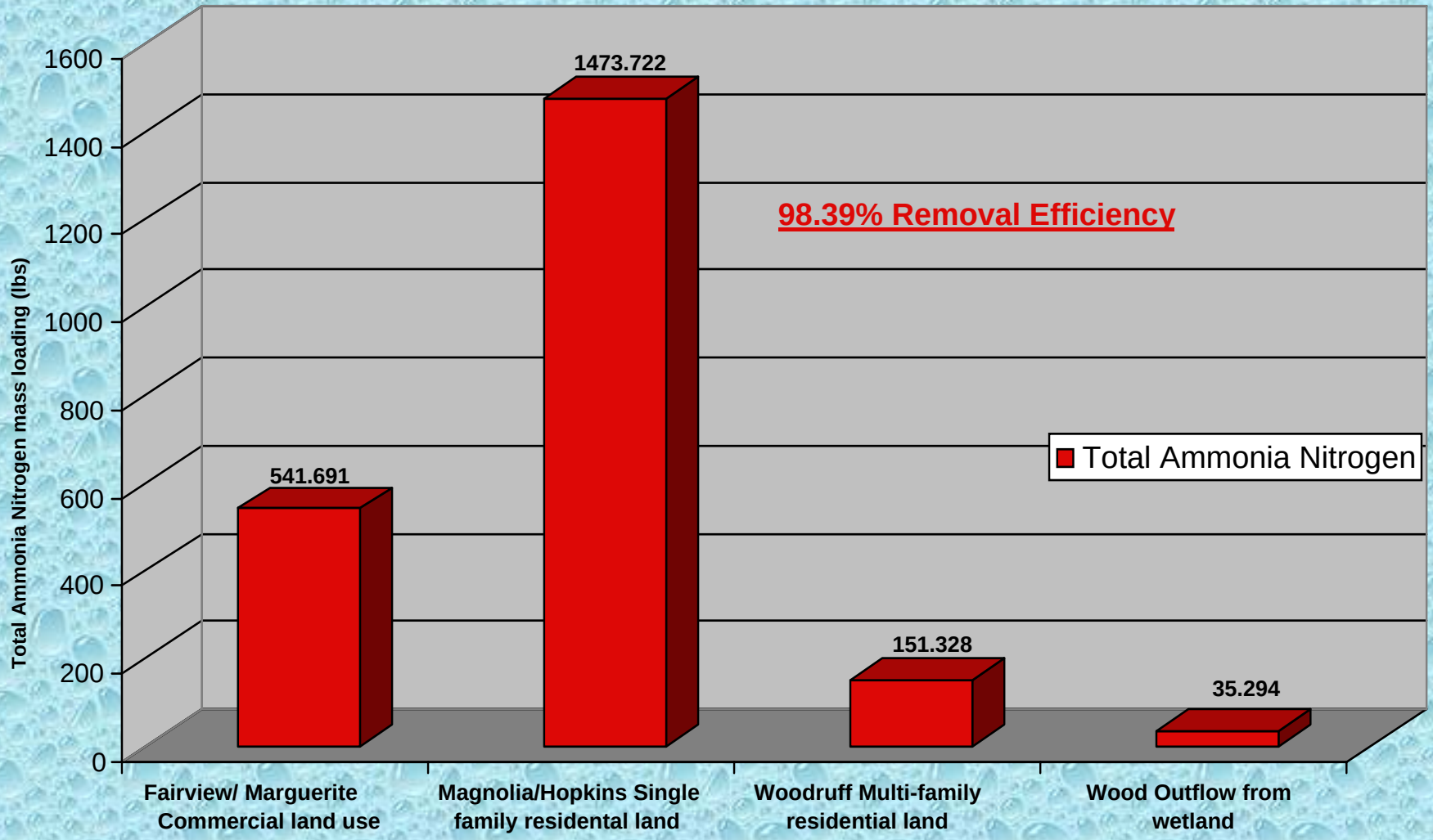
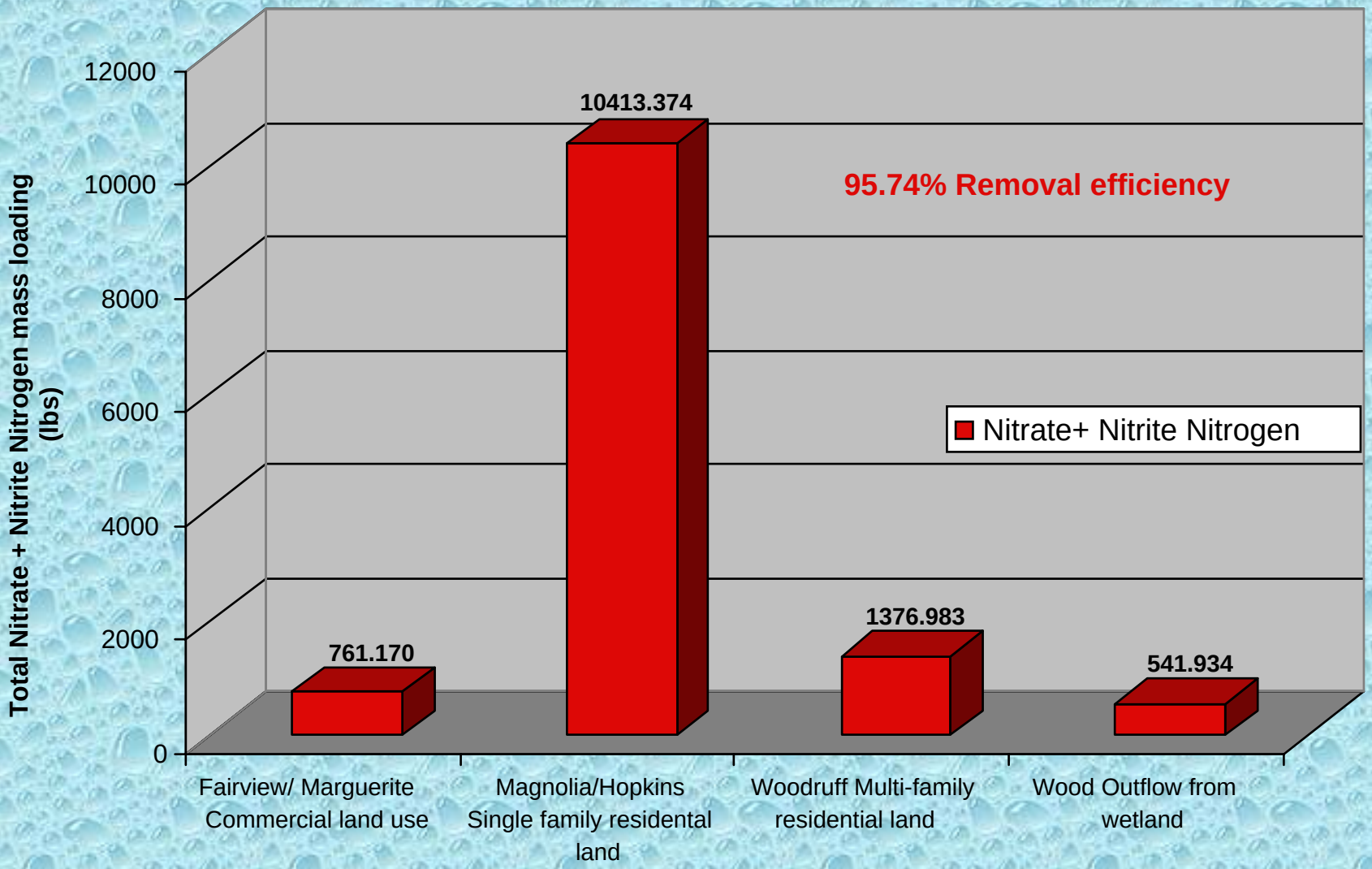
MASS LOADINGS FOR TOLLGATE WETLAND STATIONS TOTA

AMMONIA NITROGEN



MASS LOADINGS FOR TOLLGATE WETLAND STATIONS

TOTAL NITRATE + NITRITE NITROGEN



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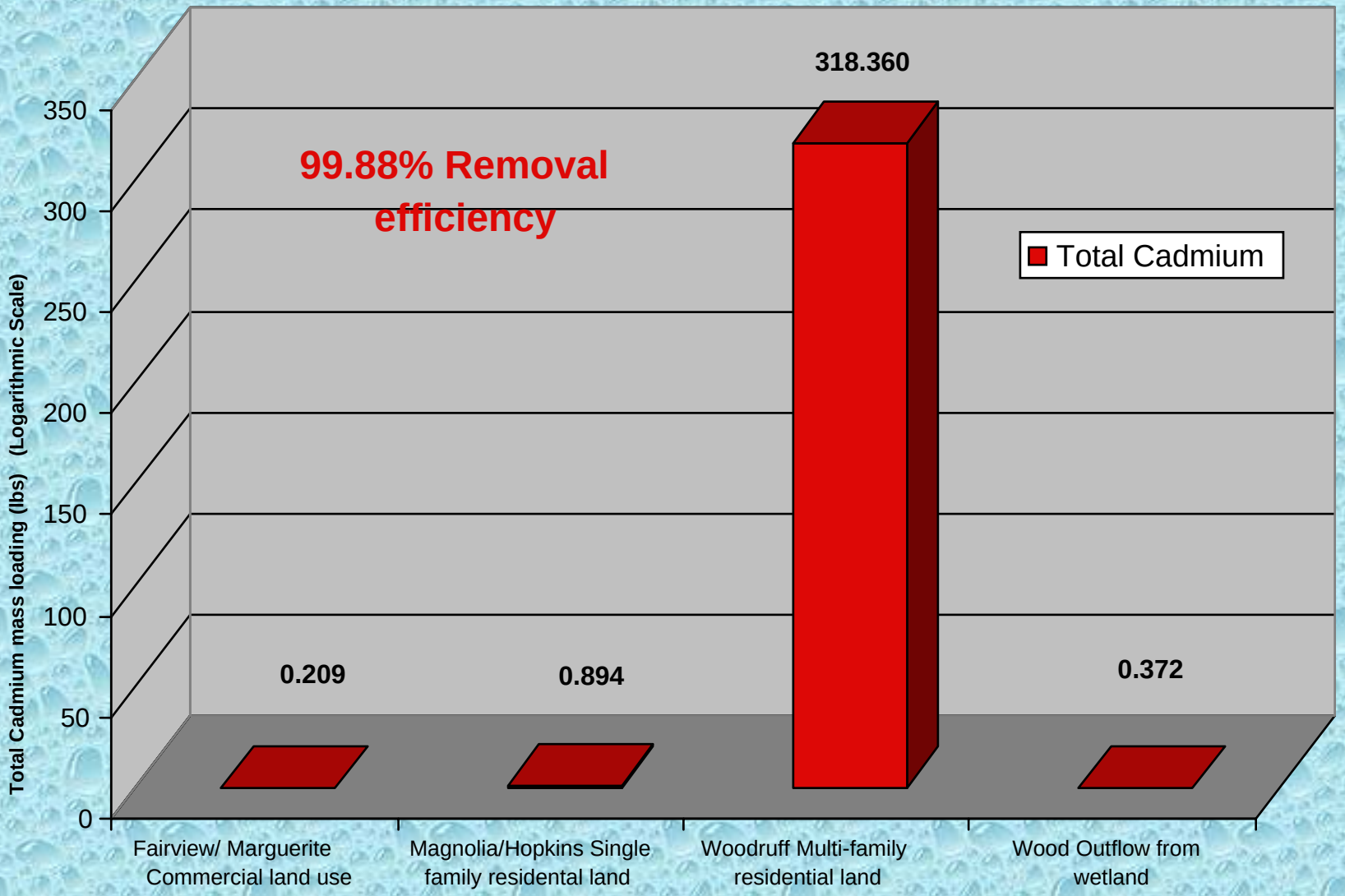
MASS LOADINGS FOR TOLLGATE WETLAND STATIONS
TOTAL CADMIUM



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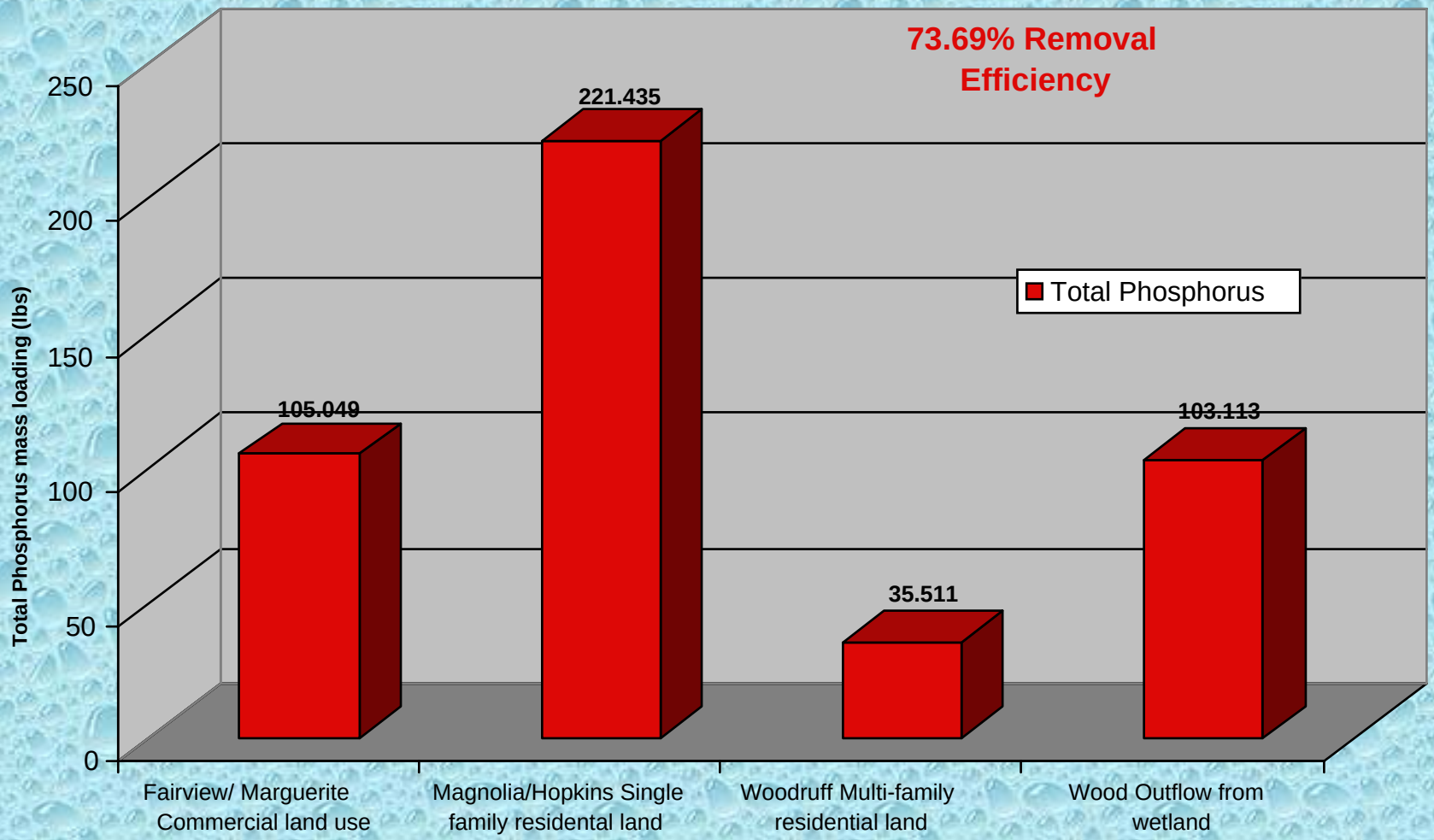
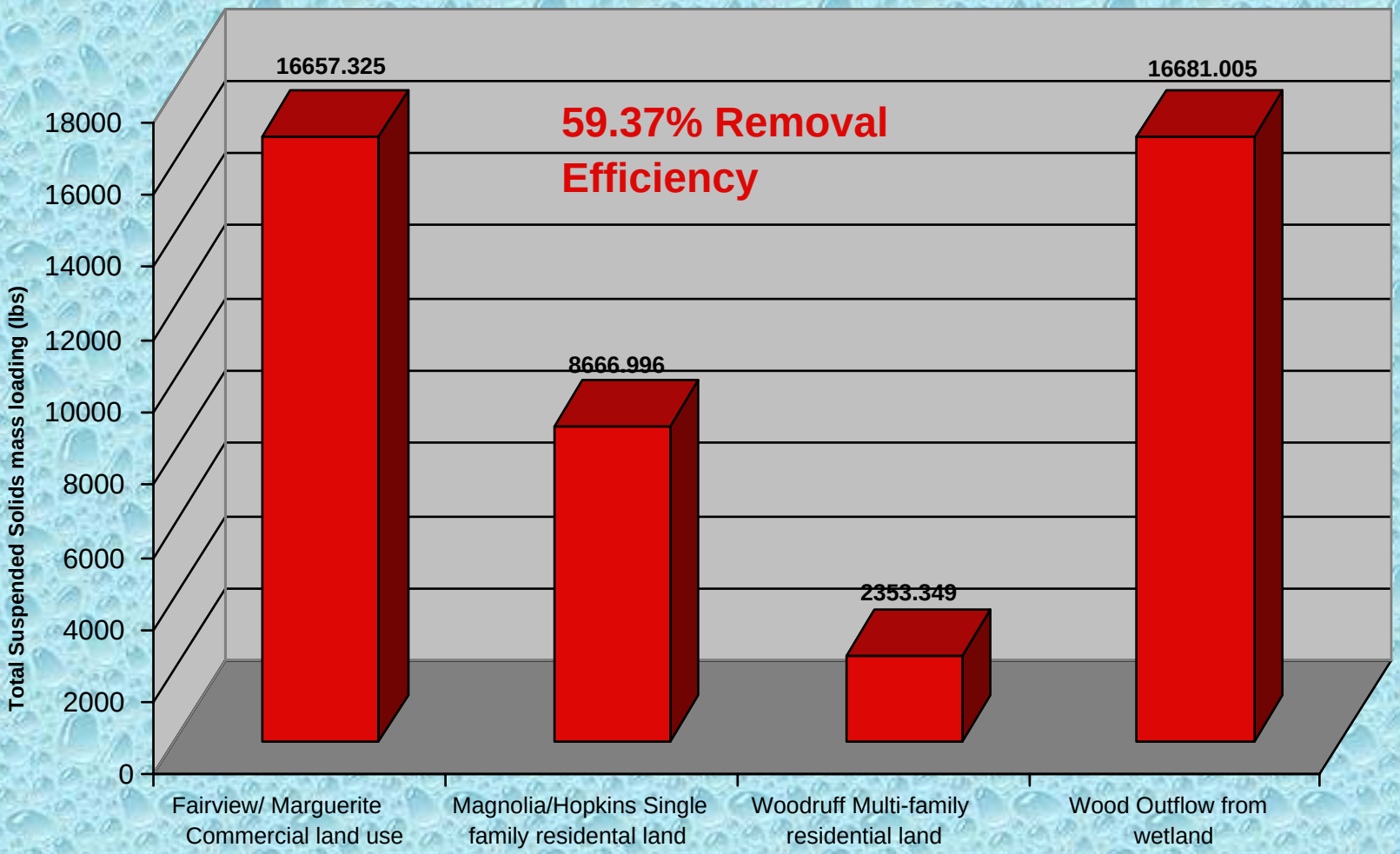
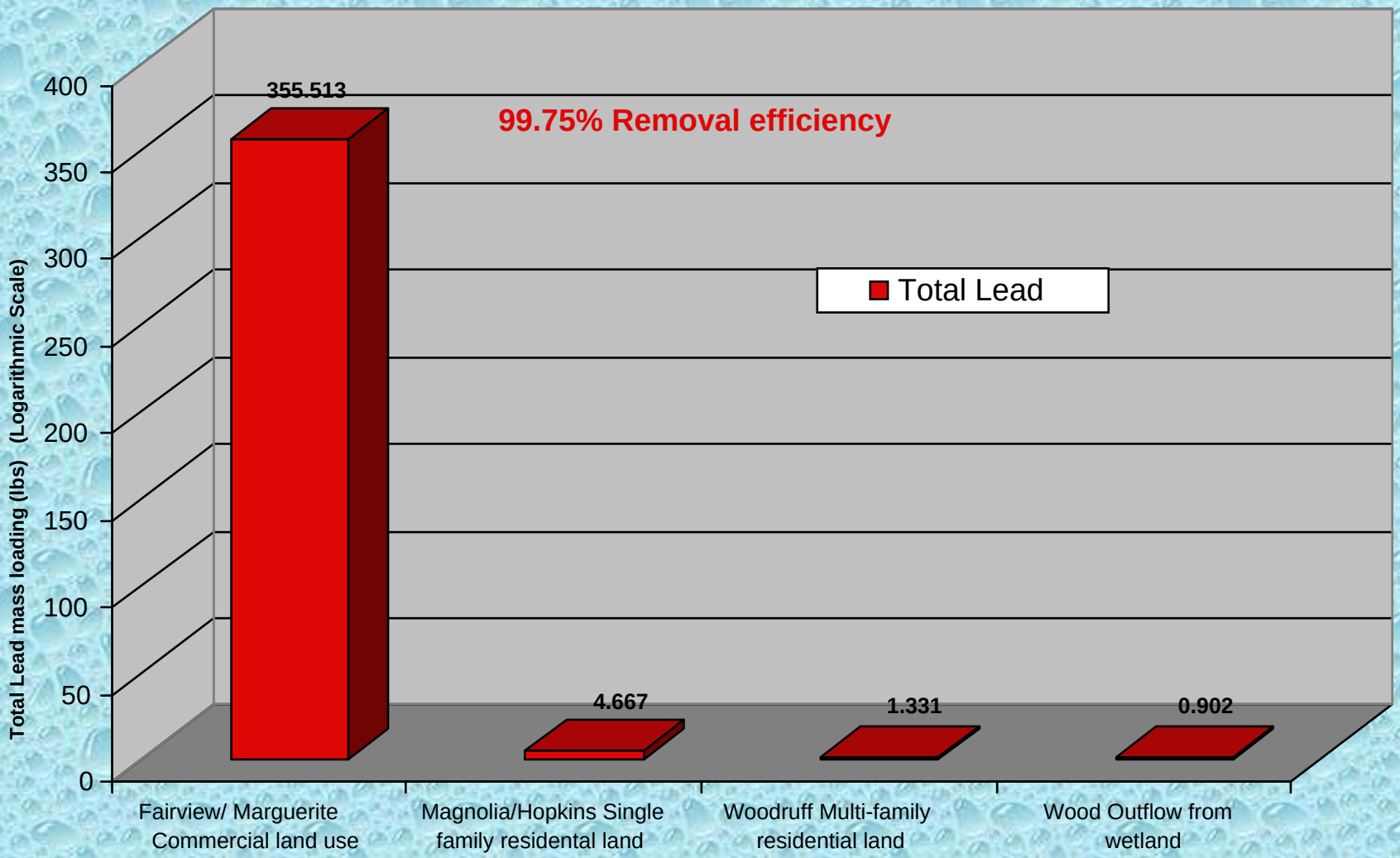
MASS LOADINGS FOR TOLLGATE WETLAND STATIONS
TOTAL PHOSPHORUS



MASS LOADINGS FOR TOLLGATE WETLAND STATIONS
TOTAL SUSPENDED SOLIDS



MASS LOADINGS FOR TOLLGATE WETLAND STATIONS
TOTAL LEAD



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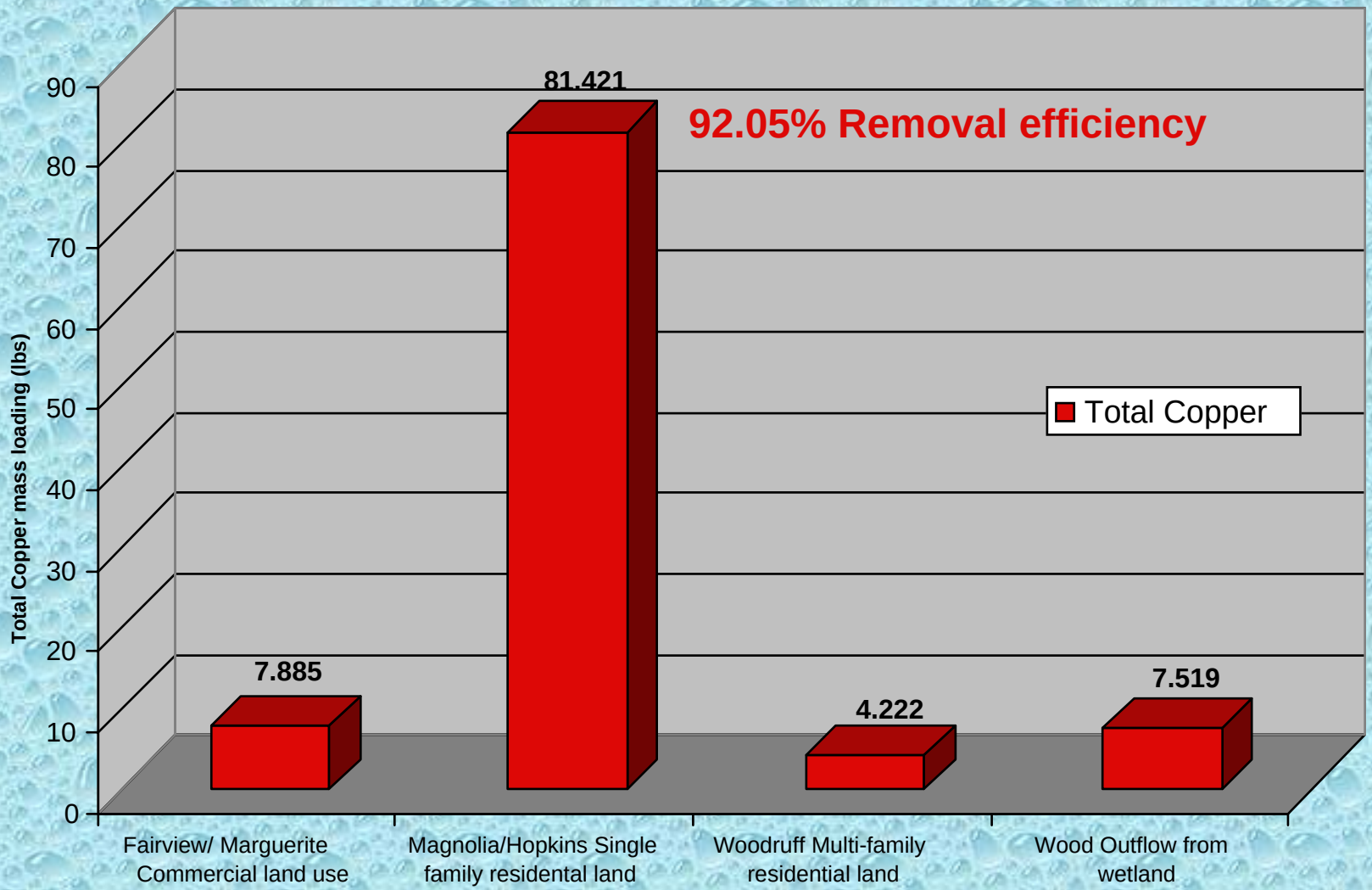

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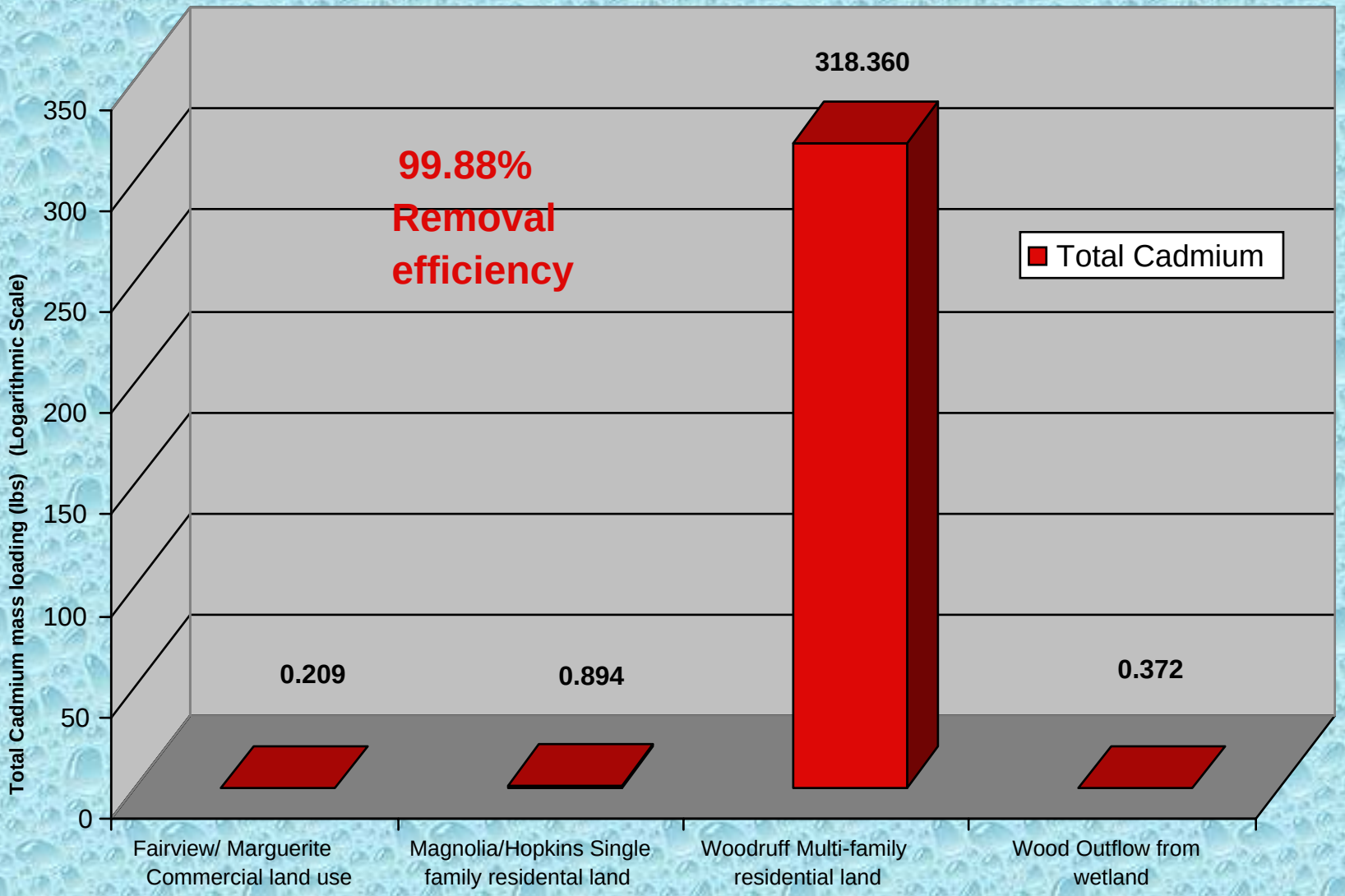
MASS LOADINGS FOR TOLLGATE WETLAND STATIONS
TOTAL CADMIUM



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Conclusions

Urban Retrofit Opportunities for Stormwater Management:

- Can Meet Multi-objective Goals
- Can Make Good Short- and Long-Term Financial Sense
- Can Facilitate Social Change for Environmental Stewardship

Conclusions

- **An Upfront Investment in Social Attitude and Behavior Change is a Good Investment**
- **Retrofitting Water Resource Protection into Urban Environments Will be More Successful When Accompanied by Education and Public Outreach**

The Enigma

- Urban residents spend millions of dollars to divert water from cities
- The same population spends millions of dollars to live or vacation near water

Every Neighborhood should have one

INGHAM COUNTY CLEAN WATER DRAIN COMMISSIONER Patrick E. Lindemann

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